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Special Section Article

Explaining the rise and fall of psychological distress during the COVID-19 crisis in the United States: Longitudinal evidence from the Understanding America Study

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Objectives. It has been shown that psychological distress rose rapidly as the COVID-19 pandemic emerged and then recovered to pre-crisis levels as social lockdown restrictions were eased in the United States. The aim of the current study was to investigate psychosocial and behavioural factors that may explain the rise and fall of distress during the initial months of the COVID-19 crisis.

Design. This study examined six waves of longitudinal nationally representative data from the Understanding America Study (UAS) collected between March and June 2020 (N = 7,138, observations = 34,125).

Methods. Mediation analysis was used to identify whether changes in distress (PHQ-4) during the COVID-19 pandemic were explained by the following factors: perceived infection risk and risk of death, perceived financial risks, lifestyle changes resulting from the virus, perceived discrimination related to the virus, and changes in substance use and employment status.

Results. All mediating factors played a role in explaining changes in distress and together accounted for 70% of the increase in distress between 10-18 March and 1-14 April and 46.4% of the decline in distress between 1-14 April and early June 2020. Changes in perceived health risks were most important in explaining changes in distress followed by changes in lifestyle and the perceived financial risks associated with COVID-19.

Conclusions. This study provides longitudinal population-based evidence detailing the mediating factors explaining changes in distress during the COVID-19 crisis. Perceived health risks associated with the virus may play a key role in explaining rising and falling levels of psychological distress during the COVID-19 pandemic.

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Statement of contribution

What is already known on this subject?

- How the global spread of COVID-19 may relate to changes in mental health is unclear.
- Longitudinal nationally representative studies addressing this topic are scarce.
- This study examines mediators of changes in psychological distress during the COVID-19 crisis.

What does this study add?

- Proposed mediating factors explain more than half of changes in distress during the pandemic.
- Changes in perceived COVID-19 infection and mortality risk explain changes in distress.
- Lifestyle changes resulting from the pandemic and perceived financial risks are also important.

Background

The COVID-19 pandemic has produced a major physical disease burden across the world. For example, in the United States alone there had been more than 5.8 million cases and over 180,000 deaths caused by COVID-19 by the end of August 2020. As the pandemic emerged, there were also concerns over the potential damaging effects that the COVID-19 crisis and associated containment measures may have on mental health (Holmes et al., 2020; Pfefferbaum & North, 2020). In line with these concerns, longitudinal studies have provided evidence of an increase in mental health problems as the COVID-19 crisis emerged. In a nationally representative study of UK adults, the prevalence of mental health problems rose by over 50% from 2017 to 2019 to April 2020 during the social lockdown in the UK (Daly, Sutin, & Robinson, 2020). Similarly, levels of depression, distress and loneliness rose during the initial stages of the COVID-19 crisis among US adults (Daly, Sutin, & Robinson, 2021; McGinty, Presskreischer, Han, & Barry, 2020).

Although there is now convincing evidence that mental health problems increased as a result of the COVID-19 crisis, the factors responsible for this have been less well studied. The crisis has had a wide range of psychological, social and economic consequences, and the relative impact and contribution these have had on population-level mental health remain to be clarified. This is in part because there has been a lack of longitudinal research which has tracked both individual trajectories of mental health and factors explaining changes in mental health during the pandemic. However, a large body of cross-sectional provides initial evidence on potential contributing factors.

For example, people's perceived risk of getting sick and dying may be particularly salient and anxiety-provoking during the initial stages of the pandemic when the likely consequences of the virus spread are uncertain (Salari et al., 2020; Shigemura, Ursano, Morganstein, Kurosawa, & Benedek, 2020). In line with this idea, those who perceive their personal risk of COVID-19 infection as high have shown to experience COVID-19-related anxiety and poorer psychological well-being and anxiety and depression in the early stages of the pandemic in the UK (Shevlin, McBride, et al., 2020; Shevlin, Nolan, et al., 2020; Jia et al., 2020). This reaction is compatible with the health belief model (Strecher & Rosenstock, 1997) which suggests that those who believe they are susceptible to COVID-19, and that the disease is severe, will perceive the disease as particularly threatening which is likely to generate negative affective responses (Mukhtar, 2020).

The threat reaction can be beneficial in that people are likely to take self-protective actions to mitigate health risks where possible. In the case of COVID-19, those who perceive the health risks associated with the disease as greater have been shown to be more likely to engage in handwashing and social distancing behaviour (Bruine de Bruin &

Bennett, 2020). While self-isolating is an effective response to the COVID-19 threat, it is likely to have adverse emotional effects (Brooks et al., 2020). Similarly, the interference of the virus with the pursuit of daily life including engagement in socializing and leisure pursuits has been linked to reduced well-being (Lades, Laffan, Daly, & Delaney, 2020). Likewise, less physical social contact and loneliness have also been shown to be associated with mental health difficulties during the early stages of the pandemic in US adults (Rosenberg, Luetke, Hensel, Kianersi, & Herbenick, 2020).

Concerns over finances and economic instability resulting from lockdown measures have also been linked to worse mental health during the pandemic (García-Fernández, Romero-Ferreiro, López-Roldán, Padilla, & Rodriguez-Jimenez, 2020; Wright, Steptoe, & Fancourt, 2020). Further, an extensive literature has shown that financial hardship exerts a particularly adverse effect on ones sense of self-worth and personal agency that together contribute to diminished mental health (Frankham, Richardson, & Maguire, 2020). Job loss can have similar unfavourable psychological effects and impacting the 'latent functions' of work including having a defined time structure to the day, social contact, clear goals and purposes, and a sense of personal status (Jahoda, 1982). Perhaps for these reasons, unemployment has been shown to have a robust and enduring negative effect on mental health and well-being (Paul & Moser, 2009). As such, it is likely that the adverse economic impact of the pandemic, particularly on financial worries and job loss, may be at least partly responsible for an associated rise in distress as the crisis emerged.

Considering individual coping strategies to deal with the stress of COVID-19 is also likely to be key. For instance, motivational models of substance use would predict increases in drinking to cope in response to psychological stress (Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016). Emerging evidence suggests that problematic drinking behaviour increased during the pandemic and is associated with increased perceived COVID-19 threat and related psychological distress (Daly & Robinson, 2020a, 2020b; Rodriguez, Litt, & Stewart, 2020). Using alcohol or other commonly used substances such as cannabis to cope with COVID-19 may have an adverse effect in promoting increased depressive symptoms and distress over time (Gobbi et al., 2019; Li et al., 2020). Based on social identify threat theory (Major & O'Brien, 2005), discriminatory experiences because of COVID-19 may also be important in understanding mental health responses to the pandemic. In line with this, one study of US adults has found that perceived personal discrimination due to COVID-19 was associated with increases in psychological distress during the early stages of the pandemic (Liu, Finch, Brenneke, Thomas, & Le, 2020).

To summarize, a range of factors may have contributed to the rise in distress observed as the COVID-19 crisis developed and based on existing theory it was hypothesized that increasing perceived infection risk and risk of death, perceived financial risks, lifestyle changes resulting from the virus, perceived discrimination related to the virus, and changes in both substance use and employment status may have played key roles. The present study tested these factors as potential mediators of changes in distress among US participants early on in the crisis.

As well as studying the factors contributing to increases in mental health problems during the pandemic, it will also be informative to understand which factors facilitate mental health recovery. A recent study found that psychological distress rose rapidly as the COVID-19 pandemic emerged and then recovered to pre-crisis levels as social lockdown restrictions were eased in the United States (Daly & Robinson, 2020c). However, it remains largely unclear what changes facilitated recovery in levels of distress and whether the same factors that may be responsible for rises in distress (e.g., perceived risk of death from COVID-19 increasing) also explain subsequent falls (e.g., perceived risk

of death declining). Identifying key mediators of changes in population mental health during the pandemic has potential to inform efforts to minimize mental health burden associated with the emergence of COVID-19. Therefore, the aim of the current study was to use longitudinal data from a large nationally representative sample to investigate psychosocial and behavioural factors that may explain the rise and fall of distress among US adults during the COVID-19 crisis.

Methods

Participants

The current study used data from the Understanding America Study (UAS), a nationally representative study that started in 2014 (Alattar, Messel, & Rogofsky, 2018). The UAS is a probability-based longitudinal study of 9063 adults recruited using address-based sampling from the US Postal Service Computerized Delivery Sequence file covering almost 100% of US households. As part of the UAS recruitment, those without Internet access were provided with a tablet computer and Internet access. This allowed UAS surveys to be completed online in a representative sample of the US population. This study utilizes data from six waves of UAS web surveys tracking the behavioural and psychosocial responses of the COVID-19 crisis from 10 March to 9 June 2020 (Kapetyn et al., 2020). The set of measures examined in this study were included specifically for the COVID-19 study and not available prior to this point.

From the 8,547 UAS participants who were eligible to participate in the COVID-19 study, data were available for 7,138 individuals who provided complete data on 4.8 of the 6 survey waves on average (total observations = 34,125). The baseline assessment consisted of responses to the first wave of the survey completed between 10 and 18 March (N = 5,549). In total, 1099 (2.9% of total observations) responses made between 19 and 31 March were excluded as this period marked the beginning of state-wide stay-at-home orders (starting with California on 19 March). The number of COVID-19 cases in the United States also escalated rapidly during this period from 5,000 to over 25,000 cases per day (Schuchat, 2020). In addition, 1,577 survey responses (4.2% of total observations) were excluded because they were submitted outside of the assigned 14-day survey period associated with each survey wave. Finally, observations were excluded in instances where a participant did not provide complete data on all study variables (i.e., psychological distress, covariates, and mediators) for a given wave. These exclusion criteria resulted in a small portion of observations being dropped (2.5%) because one or more study variables were not collected for a specific study wave. The sample size for each of the study waves was as follows: 10–18 March (Wave 1: N = 5,549), 1–14 April (Wave 2: N = 5,146), 15–28 April (Wave 3: N = 5,936), 29 April–12 May (Wave 4: N = 5,916), 13–26 May (Wave 5: N = 5,794) and 27 May–9 June (Wave 6: N = 5,784).

To ensure that the baseline assessment (10–18 March) was comparable to subsequent survey waves, a series of multinomial regression analyses were conducted to test whether the baseline level of each demographic characteristic differed from levels observed in subsequent survey waves. This analysis did not reveal any significant differences, suggesting that the exclusion of responses submitted in late March did not significantly impact the representativeness of the Wave 1 sample (see Tables S1 and S2).

Measures

Psychological distress

The Patient Health Questionnaire (PHQ-4) was used to assess psychological distress in each of the six survey waves examined. The PHQ-4 is a widely used and well-validated measure comprised of two items from the PHQ-9 depression measure and two items from the Generalized Anxiety Disorder-7 (GAD-7) (Kroenke, Baye, & Lourens, 2019; Kroenke, Spitzer, Williams, & Löwe, 2009; Löwe et al., 2010). The scale assesses the frequency of core symptoms of depressive symptoms (e.g., 'Feeling down, depressed, or hopeless') and anxiety disorders (e.g., 'Feeling nervous, anxious or on edge') over the past two weeks. Each item is rated on a four-point scale scored as 0 ('not at all'), 1 ('several days'), 2 ('more than half the days'), or 3 ('nearly every day') producing a scale ranging from 0 to 12 with higher scores indicating elevated distress levels. Scores on the PHQ-4 have been found to correlate strongly with their parent scale scores (PHQ-9, GAD-7), to show similar correlations with measures of functional status, and to be sensitive to changes in mental health (Kroenke et al., 2009, 2019; Löwe et al., 2010). In this study, the reliability of the PHQ-4 was 0.9 (average of individual wave reliability estimates). Total PHQ-4 scores were standardized across all time points to retain longitudinal changes and produce a scale with a mean of 0 and standard deviation of 1 across all observations. We also outline the percentage of participants scoring above a total score of ≥ 6 indicating moderate-to-severe distress (Kroenke et al., 2009).

Mediating variables

In each study wave, seven potential mediating variables were examined in order to explain changes in psychological distress during the COVID-19 crisis. In five of the six waves, participants were asked whether they had tested positive for COVID-19 since the last wave. In total, there were 31 positive cases which would not provide sufficient statistical power to warrant the inclusion of a positive COVID-19 test as a potential mediating factor in this study.

Perceived risk of infection and of death due to COVID-19. To gauge participants' perceptions of the risk of infection with COVID-19 participants were asked: 'On a scale of 0 to 100 percent, what is the chance that you will get the coronavirus in the next three months?' which was followed by a second item asking participants to report 'If you do get the coronavirus, what is the percent chance you will die from it?' which was rated on the same 0 to 100 per cent scale. Where participants were unsure, they were asked to provide their best guess.

Perceived financial risk due to COVID-19. The financial risk posed by COVID-19 was assessed using a single-item that asked participants to report 'the percent chance you will run out of money because of the coronavirus in the next three months?'. Once again, where participants were unsure, they were asked to provide their best guess.

Lifestyle changes due to COVID-19. Changes in everyday activities due to the COVID-19 pandemic were assessed using four items assessing whether or not participants had taken

the following steps to keep themselves safe from the coronavirus in the past week: cancelled or postponed personal or social activities, cancelled or postponed air travel for pleasure, cancelled or postponed work or school activities, or worked or studied at home. Each item was coded as a binary variable (1 = yes, 0 = no), and a total score was generated by taking an average of the four items (Cronbach's $\alpha = 0.70$).

Substance use during the pandemic. Participants reported their estimate of the number of days in the past week they engaged in each of the following activities: consumed alcohol, consumed cannabis products such as marijuana, or consumed other recreational drugs. The average number of days in the last seven that participants engaged in these activities was used as an indicator of their recent substance use.

Perceived discrimination due to COVID-19. Possible discrimination perceived to occur because others believed the participant had the coronavirus was assessed using four items adapted from the Perceived Everyday Experiences with Discrimination Scale (Williams, Yu, Jackson, & Anderson, 1997). These assessed whether participants were 'treated with less courtesy and respect than other people', 'received poorer service than other people at restaurants or stores', 'people acted as if they were afraid of you', or 'were threatened or harassed'. In each wave participants who positively endorsed any of these items, they were classified as experiencing discrimination.

Employment status during the pandemic. In each wave, participants were asked 'do you currently have a job'. In order to align this variable with the other mediating variables (where high scores may predict raised distress), this item was coded as a binary variable where 1 = Not employed and 0 = Employed.

Covariates

Participants reported their age in years, sex (male, female), race/ethnicity (White, Hispanic, Black, Other race/ethnicity), and their annual household income levels (grouped into three categories: ≤$40,00, $40,000–$100,000, and ≥$100,000 gross per annum). Participants were grouped into four approximately even-sized age groups (18–34, 35–49, 50–64, and 65 + years).

Statistical analysis

A previous examination of the UAS sample has shown that psychological distress increased markedly between 10-18 March and 1-14 April 2020 and then decreased between 1-14 April to June 2020 (Daly & Robinson, 2020c). As a first step, in this study this trend was replicated in the current sample. Changes in distress were then examined using a linear (OLS) regression model with robust standard errors clustered at the individual level to account for non-independence of repeated assessments of individuals across study waves. Distress levels from 1 to 14 April (the point when psychological distress peaked in this sample) were compared to baseline (10-18 March) levels and then to distress levels in subsequent study waves. Estimates were adjusted for sociodemographic background characteristics (i.e., age, sex, race/ethnicity, household income).

Next, this OLS regression model was used to examine changes in each of the continuous mediating variables in turn. For dichotomous mediators (i.e., employment status, perceived discrimination), a logistic regression model with clustered standard errors was used. The purpose of these analyses was to identify whether the mediating variables followed a similar pattern to psychological distress: increasing between 10-18 March and 1-14 April and decreasing from this point to early June. Next, mediation analysis was used to test whether changes in the potential mediating variables could explain increases and decreases in psychological distress over these two respective periods.

The Karlson–Holm–Breen (KHB) method implemented using the khb command in Stata (Karlson, Holm, & Breen, 2012) was used to test for the presence of mediation. This method is appropriate for examining outcomes measured repeatedly over time and provides an adjustment for rescaling issues that occur when making cross-model comparisons when one or more of the mediating variables is non-continuous (e.g., discrimination, employment status). In this study, khb performed the necessary decomposition to estimate the magnitude and statistical significance of the indirect effects of all seven mediators in explaining why distress increased and decreased during the study.

Finally, a complete case test was conducted where the mediation analysis was repeated only among participants who completed all six survey waves. In all analyses, UAS sampling weights were applied to produce nationally representative estimates. The sampling weights are generated for each survey wave and account for unequal sampling probabilities of participants into the UAS survey and align each wave of the survey with the sociodemographic characteristics of the US population (Kapetyn et al., 2020).

Results

Sample characteristics for the full sample are provided in Table 1 and for each study wave in Table S1. Participants were predominantly female (51.2%) with an average age of 49 years (SD = 16.5). In line with prior estimates (Daly & Robinson, 2020c), distress levels increased by 0.8 points from 10-18 March (M = 1.82, SD = 2.77) to 1-14 April (M = 2.62, SD = 3.09) and then decreased by 0.82 points to a mean of 1.80 (SD = 2.74) by early June (27 May –9 June). In an OLS regression model that adjusted for background characteristics, the increase in standardized distress levels from 10-18 March to 1–14 April was 0.27 SD (95% CI [0.23–0.32], $p < .001$) and the subsequent decline by early June was 0.28 SD (95% CI [0.24–0.32], $p < .001$), as shown in Table 2 and Figure 1a. The percentage of participants reporting moderate-to-severe distress increased from 10.5% (10-18 March) to 16% (1-14 April) and then declined to 9.8% (27 May–9 June).

Changes in mediating variables during the COVID-19 crisis

An examination of changes in each of the mediating variables showed that all mediators appeared to increase between 10-18 March and 1-14 April and then decrease from this point to the 27 May–9 June assessment, as shown in Figure 1 and Figures S1 and S2. The statistical significance of the increases and decreases in each of the mediating variables across these two periods was therefore tested.

Table 1. Descriptive statistics for the Understanding America Study (UAS) sample

Variable	%/ *M* (*SD*)
Age, years	49 (16.5)
Age group	
18–34	22.6
35–49	29.6
50–64	26.9
65+	20.9
Female	51.2
White	67.0
Hispanic	15.6
Black	11.5
Other race/ethnicity	6.0
Low income[a]	36.2
Middle income[a]	40.4
High income[a]	23.4
Psychological distress score by wave (date): Wave 1 (10–18 March)	1.82 (2.77)
Wave 2 (1–14 April)	2.62 (3.09)
Wave 3 (15–28 April)	2.28 (3.01)
Wave 4 (29 April–12 May)	2.02 (2.78)
Wave 5 (13–26 May)	1.86 (2.75)
Wave 6 (27 May–9 June)	1.80 (2.74)

Note. Total *N* = 7138. Total obs. = 34,125. Estimates are derived from weighted data.
[a]Households earning less than $40,000 a year classified as low income, those earning $40,000–$100,000 middle income, and those above this threshold as high income.

Perceived risk of infection with COVID-19

At baseline (10-18 March), participants reported the per cent chance of being infected with COVID-19 in the next three months as 20.2% (95% CI [19.4, 21.0]). Regression analysis indicated that the anticipated risk of infection increased significantly by 7.7% (95% CI [6.7–8.7], $p < .001$) from 10–18 March to 1–14 April and then declined significantly by 7.3% (95% CI [6.4–8.3], $p < .001$) by the beginning of June, as shown in Table 2 and illustrated in Figure 1b. The perceived risk of infection did not differ between 10-18 March and early June, as shown in Table 2.

Perceived risk of death due to COVID-19

In mid-March, participants rated their probability of dying if infected with COVID-19 as 14.6% (95% CI [13.8–15.4]). The perceived risk of death increased markedly by 10.2% (95% CI [9.2–11.1], $p < .001$) between 10-18 March and 1–14 April as the number of deaths recorded due to COVID-19 in the US rose exponentially from 52 (week ending 14 March) to 16014 (week ending 11 April) (CDC, 2020). The perceived risk of death then declined by 5.4% (95% CI [4.66.3], $p < .001$) by early June and remained significantly above mid-March levels (see Table 2 and Figure 1c).

Table 2. Regression estimates of the magnitude of the increase (10–18 March to 1–14 April) and decrease (1–14 April to 27 May-9 June) in psychological distress and all mediating variables examined in the Understanding America Study (UAS) (N = 7138, Obs. = 34,125)

	Increase 10–18 March to 1–14 April	Decrease 1–14 April to 27 May–9 June	Difference (increase – decrease)
Variable	B [95% CI]	B [95% CI]	B [95% CI]
Psychological distress[a]	0.27*** [0.23, 0.32]	0.28*** [0.24, 0.32]	-0.01 [−0.04, 0.03]
Mediating variables			
Perceived risk of infection[b]	7.65*** [6.65, 8.65]	7.33*** [6.38, 8.28]	0.32 [−0.61, 1.24]
Perceived risk of death[b]	10.15*** [9.22, 11.08]	5.43*** [4.56, 6.28]	4.73*** [3.83, 5.63]
Perceived financial risk[b]	7.42*** [6.27, 8.57]	6.33*** [5.22, 7.43]	1.10* [0.07, 2.11]
Lifestyle changes[c]	1.29*** [1.23, 1.35]	0.97*** [0.91, 1.02]	0.32*** [0.26, 0.38]
Substance use[d]	0.19*** [0.15, 0.23]	0.09*** [0.05, 0.13]	0.11*** [0.07, 0.14]
Perceived discrimination[e]	6.08*** [4.64, 7.52]	4.44*** [2.95. 5.94]	1.64** [0.50, 2.78]
Not in employment[e]	11.08*** [8.84, 13.33]	1.92 [0.4, 4.21]	9.15*** [7.61, 10.69]

Note. All models are adjusted for covariates (participant age, sex, race/ethnicity, and household income). [a]Standardized PHQ-4 scores.; [b]Percentage risk with a possible range from 0 to 100.; [c]Number of four lifestyle changes made in the past week.; [d]Average number of days per week consumed alcohol, cannabis, other recreational drugs.; [e]Estimates are percentage point estimates (i.e., percentage experiencing discrimination, percentage not in employment) derived from predicted probabilities from marginal effects calculated after a logistic regression model clustered by the individual participant identifier and controlling for covariates.; *$p < .05$.; **$p < .01$.; ***$p < .001$.

Perceived financial risk due to COVID-19

At baseline (10-18 March), participants reported that the per cent chance they would run out of money in the next three months due to COVID-19 was 14% (95% CI [13.1–14.9]) on average. The perceived financial risk posed by COVID-19 increased significantly by 7.4% (95% CI [6.3–8.6], $p < .001$) by 1–14 April and then declined by 6.3% (95% CI [5.2–7.4], $p < .001$) by early June (see Table 2 and Figure 1d).

Lifestyle changes due to COVID-19

In mid-March, participants reported having made 1.06 (95% CI [1.01-1.10]) of the four lifestyle changes due to COVID-19 (e.g., cancelled or postponed personal or social activities) in the past week. The number of recent changes made increased substantially by 1.29 (95% CI [1.23–1.35], $p < .001$) between 10–18 March and 1–14 April and then decreased significantly by 0.97 (95% CI [0.91–1.02], $p < .001$) by the 27 May–9 June assessment but remained significantly above mid-March levels (Table 2 and Figure 1e).

Perceived discrimination due to COVID-19

In mid-March, 4.8% (95% CI [4.0–5.6]) of participants reported experiencing discrimination due to people thinking they may have COVID-19. This percentage increased by 6.1% by 1–14 April (95% CI [4.6–7.5], $p < .001$), as shown in Table 2. A

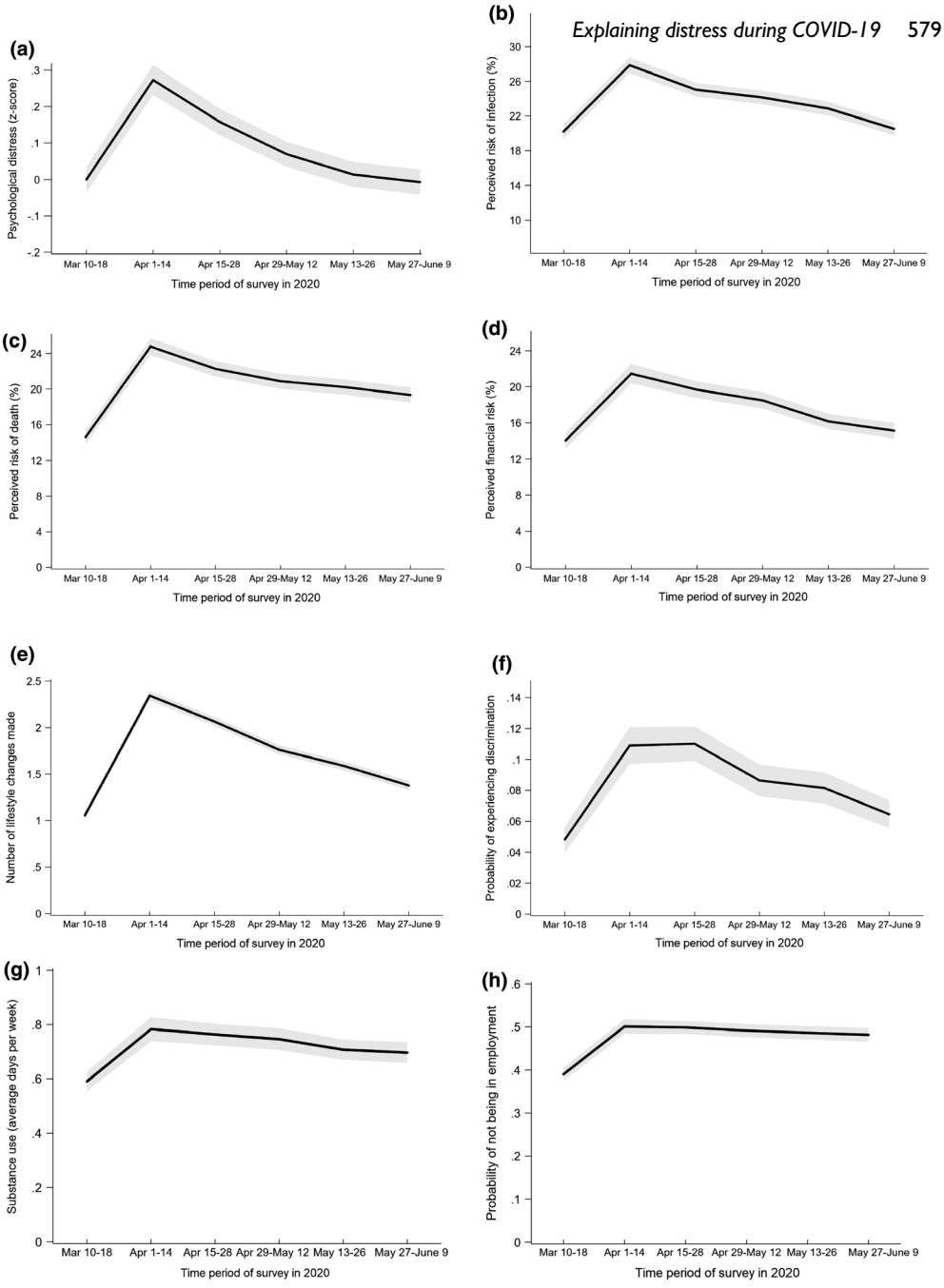

Figure 1. Changes in key study variables throughout the emergence of the COVID-19 crisis from 10 March to 9 June 2020 including (a) psychological distress, (b) perceived risk of infection with COVID-19 in the next 3 months, (c) perceived risk of death if infected with COVID-19, (d) perceived financial risk/ risk of running out of money in the next 3 months due to COVID-19, (e) lifestyle changes made in the past seven days due to COVID-19, (f) perceived discrimination due to others thinking the participant has COVID-19, (g) substance use during the COVID-19 pandemic, and (h) changes in employment status. Estimates are adjusted for participant age, sex, race/ethnicity, and household income. 95% confidence intervals presented in grey

Table 3. Role of mediating variables in explaining the increase and decrease in psychological distress during the emergence of the COVID-19 crisis in the United States

	Increase 10-18 March to 1-14 April		Decrease 1-14 April to 27 May–9 June	
Coefficient	β	SE	β	SE
Total effect[a]	0.273***	0.021	0.280***	0.019
Direct effect[b]	0.082**	0.024	0.150***	0.021
Indirect effect[c]	0.191***	0.017	0.130***	0.015
via Perceived infection risk	0.028***	0.005	0.027***	0.004
Perceived risk of death	0.029***	0.006	0.015***	0.004
Perceived financial risk	0.038***	0.005	0.033***	0.005
Lifestyle changes	0.040***	0.011	0.030***	0.008
Substance use	0.021***	0.004	0.009***	0.003
Perceived discrimination	0.018***	0.003	0.013***	0.003
Not in employment	0.018***	0.004	0.003*	0.001
Total mediation percentage	70.1	–	46.4	–
via Perceived infection risk	10.2	–	9.5	–
Perceived risk of death	10.5	–	5.5	–
Perceived financial risk	14.0	–	11.7	–
Lifestyle changes	14.6	–	10.7	–
Substance use	7.7	–	3.4	–
Perceived discrimination	6.5	–	4.7	–
Not in employment	6.5	–	1.1	–

Note. All estimates are derived from a single mediation model (N = 7138, Obs. = 34,125) and are adjusted for covariates (participant age, sex, race/ethnicity, and household income).
[a]Total increase/decrease in distress.; [b]Increase/decrease in distress not explained by mediators.; [c]Increase/decrease in distress that is explained by the mediating variables.

subsequent decline in experiences of discrimination of 4.4% (95% CI [3.0–5.9], $p < .001$) was reported by early June (see Figure 1f). However, discrimination levels at this point remained significantly above levels observed in mid-March, as shown in Table 2.

Substance use during the pandemic

On average, the number of days in the last seven participants consumed alcohol, cannabis, and other recreation drugs increased significantly from 0.59 (95% CI [0.56–0.63]) in mid-March to 0.78 by 1–14 April (95% CI [0.74–0.83]) a difference of 0.19 days (95% CI [0.15–0.23]) and then declined significantly to an average of 0.70 days per week (95% CI [0.66–0.73) by early June (Table 2 and Figure 1g).

Employment status during the pandemic

39% per cent of the sample (95% CI [37.5–40.5]) were not employed at baseline (10–18 March), and this increased significantly by 11.1% (95% CI [8.8–13.3], $p < .001$) by 1–14 April. No significant change in employment status after this point was found (Table 3 and Figure 1h).

Mediation analysis

As predicted, all mediating variables were positively associated with psychological distress at the $p < .001$ level in a model that adjusted for differences in distress levels across study waves and sociodemographic background factors, as shown in Table S3.

Next, this study examined whether the seven mediating factors explained the increase in distress between 10-18 March and 1–14 April ($\beta = 0.27$, 95% CI [0.23–0.32]). Together, the mediating factors explained 70% of the increase in distress (indirect effect: $\beta = 0.19$, 95% CI [0.16–0.22], $p < .001$), as shown in Table 3. All mediating variables played a statistically significant role in explaining the rise in distress. The perceived health risk (considering both infection risk and risk of mortality) associated with COVID-19 was the most important factor in explaining the rise in distress (accounting for 20.7% of the increase), as shown in Table 3. Both perceived financial risk (14% of the increase) and lifestyle changes (14.6%) were also associated with distress rising. Increases in substance use (7.7%), perceived discrimination (6.5%), and unemployment (6.5%) each accounted for part of the rise in distress.

Collectively, the mediating factors explained 46.4% of the 0.27 *SD* decline in psychological distress (indirect effect: $\beta = 0.13$, 95% CI [0.10–0.16], $p < .001$) and all mediating variables contributed significantly to the indirect effect, as shown in Table 3. The decline in distress was accounted for chiefly by changes in perceived health risk associated with COVID-19 (accounting for 15% of the decrease) followed by changes in perceived financial risk (11.7%) and lifestyle changes (10.7%). Declines in perceived discrimination explained 4.7% of the decline in distress.

This pattern of results was replicated closely in a complete case analysis where only those with data on all study waves were included (see Table S4). In this analysis, the combined indirect effect of all mediators explained 68.4% of the increase in psychological distress from 10–18 March to 1–14 April (indirect effect: $\beta = 0.19$, 95% CI [0.15–0.23], $p < .001$) and 45.5% of the subsequent decrease in distress by June 2020 (indirect effect: $\beta = 0.12$, 95% CI [0.09–0.15], $p < .001$).

Discussion

The aim of the present study was to use longitudinal data from a large nationally representative sample to investigate psychosocial and behavioural factors that may explain the rise and fall of distress among US adults during the COVID-19 crisis. A range of factors were associated with increases in psychological distress during the early stages of the COVID-19 pandemic in the United States (March–April 2020). During this initial stage, personal health concerns (perceived risk of infection and mortality from COVID-19) rose sharply and these concerns accounted for a substantial amount of the initial rise in distress (21% of the increase). Perceived financial risks (i.e., running out of money) and changes in lifestyle characterized by reductions in social contact also increased and each explained 14-15% of the initial rise in distress. When examining mediators of recovery in psychological distress (April–June 2020), a similar pattern of results was observed for these mediators. Personal health concerns reduced as did financial concerns, and changes in lifestyle because of COVID-19 became less likely, which all mediated the decrease in psychological distress.

These findings corroborate suggestions that COVID-19-related concerns over personal health (Jia et al., 2020; Shevlin, Nolan, et al., 2020) and finances (Holmes et al., 2020) are likely to exacerbate mental health problems and that reduced social contact (Brooks et al.,

2020) as a result of measures to prevent the spread of COVID-19 may have contributed to the initial rise in distress. The other mediating factors examined played less of a central role in explaining changing patterns of distress. Both substance use, loss of employment, and perceived discrimination (due to COVID-19) increased early in the pandemic, and these factors explained a small amount of the initial sharp rise in distress. However, of these factors, only changes in perceived discrimination contributed notably to the fall in distress observed.

The present findings identify factors that could be targeted to minimize declines in mental health as the COVID-19 pandemic continues to evolve. For example, efforts to correct overestimations of perceived personal health risk may benefit mental health, as could economic support policies and measures to ensure that people do not feel stigmatized during the pandemic. However, it will be important to balance actions taken to protect mental health against infection prevention measures. In this study, as the COVID-19 virus spread through the United States and the number of infections and deaths increased, perceptions of health risk decreased among participants and this decline played a key role in explaining improvements to psychological distress. Given that perceptions of personal health risk predict engagement in behaviours that protect against spreading of the virus (Bruine de Bruin & Bennett, 2020) and many may underestimate their level of person risk (Niepel, Kranz, Borgonovi, Emslander, & Greiff, 2020), ensuring that COVID-19 health risk is accurately communicated still remains important to reducing the physical disease burden of the virus.

The findings of the present study are largely consistent with the small amount of longitudinal research that has examined factors contributing to changing patterns of mental health during the pandemic. In one US study, increases in perceived discrimination due to COVID-19 were associated with increases in distress (Liu et al., 2020). In a UK study examining mental health during the pandemic, changes in worries about a range of COVID-19-related factors (e.g., health risk, financial considerations) were linked to changing depression and anxiety (Wright et al., 2020). In the present study, many Americans lost their jobs in the early stages of the pandemic in the United States and that this partly explained rises in distress. However, this change in employment levels did not explain falls in distress, presumably because employment rates did not recover to pre-pandemic levels in the present sample. Yet, it will be important to continue to study population-level mental health in response to the pandemic, as if unemployment persists then there may be longer lasting consequences of the pandemic on mental health (Daly & Delaney, 2013).

Although the studied mediating variables explained a significant part of the decrease in distress (46%), this was less than the portion of the initial increases in distress accounted for by these factors (70%). It therefore seems likely that there are additional factors contributing to the recovery of distress that it was not possible to examine in the present study. Confidence in the government's ability to mitigate the detrimental effects of the pandemic may be one example. Stay-at-home orders in many US states were relatively short lived, and the US government introduced measures to support the income of workers who lost their jobs and extended unemployment benefits. In addition to the reductions in financial concerns observed after April 2020, such actions may have resulted in a perception that the pandemic was under some degree of control and that the potential damaging effects of the pandemic were being managed.

Some of the overall decrease in distress is also likely to be explained by psychological adjustment or 'adaptation' processes (Diener, Lucas, & Scollon, 2006; Stanton, Revenson, & Tennen, 2007). There is a large amount of research in clinical and health psychology

that has examined how people respond to stressful events (e.g., bereavement, chronic illness), and it has recently been argued that one of the most common response is that of 'recovery' (Infurna & Luthar, 2018); an initial decline in well-being caused by the stressful event, which is then followed by a period of coping and adaptation that sees well-being returning to baseline levels of well-being.

The present research may have implications for public health strategies as the COVID epidemic continues to evolve in the United States and other countries. Given that perceived health risk played an important role in explaining rises and falls in distress, messages that promote personal fears over health may be contributing to psychological distress and mental health crises that will require medical intervention. Therefore, as discussed it will be important that personal health risks surrounding COVID-19 are presented accurately and to minimize distress, other forms of public health messaging (e.g., appealing to a collective sense of responsibility to engage in protective behaviours) may be better placed to promote behaviours that reduce transmission of COVID-19 whilst minimising unnecessary psychological distress.

A strength of the present research was that it was possible to examine the role played by a range of mediating factors have had in explaining longitudinal changes in distress during the COVID-19 pandemic among a large nationally representative sample. However, this study was limited by data available and this means that there are likely to be other factors contributing to changes in distress that will be important to consider in future research. Among other factors, the impact that COVID-19 has had on access to non-COVID medical care (Al-Shamsi et al., 2020), physical activity lezvels (Robinson, Gillespie, & Jones, 2020), and interpersonal relations (e.g., experiencing conflict and forms of abuse) (Iob, Steptoe, & Fancourt, 2020) may be in part responsible for the rise and fall of distress among US adults. In addition, it is important to note that the mediation effects identified in this study may be biased due to the effect of unobserved confounders on the exposure–mediator and exposure–outcome relationships which limit the causal inferences that can be made based on the current analyses.

A further consideration is that there may be subgroups of individuals whose mental health is impacted differently during the pandemic, such as healthcare workers who may be at increased risk of stress-related 'burn out' (Hu et al., 2020). Likewise, the relative contribution that the identified mediating factors have had on rises and falls in distress may vary based on demographics. For example, ethnic minorities may be more affected by job losses and income loss (Hu, 2020), and therefore, the relative importance of financial concerns in explaining changes in distress may vary based on sociodemographic factors. Finally, the PHQ-4 is a general measure of psychological distress and more extensive measures are needed to identify factors contributing to specific mental health conditions.

Conclusions

This study provides longitudinal population-based evidence detailing the mediating factors explaining changes in distress during the COVID-19 crisis. In particular, the perceived health risks associated with the virus were found to play a key role in explaining rising and falling levels of psychological distress during the COVID-19 pandemic.

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Conflicts of interest

All authors declare no conflict of interest. ER has previously received research funding from Unilever and the American Beverage Association for unrelated research.

Data availability statement

The research data are distributed by the USC Dornsife Center for Economic and Social Research and available at https://uasdata.usc.edu/index.php

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Supporting Information

The following supporting information may be found in the online edition of the article:

Table S1. Sample characteristics in six waves of the Understanding America Study (UAS) (N = 7,138, Obs. = 34,125).

Table S2. Summary of multinomial logistic regression results comparing each characteristics of Wave 1 (March 10-18) of the Understanding America Study (UAS) with the characteristics of subsequent waves (N = 7,138, Obs. = 34,125).

Table S3. Regression estimates of the association between proposed mediating variables and psychological distress levels between March 10th to June 9th in the Understanding America Study (UAS) (N = 7,138, Obs. = 34,125).

Table S4. Complete case analysis of the role of mediating variables in explaining the increase and decrease in psychological distress during the emergence of the COVID-19 crisis in the United States.